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First record of a hydrozoan (Cnidaria, Hydrozoa) growing on a sigalionid scaleworm (Annelida, Sigalionidae)

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Abstract

The scaleworm *Pelogenia fimbriata* (Hartman, 1939) collected from Secas Islands, Panama, during the Allan Hancock Pacific Expedition in 1916, was not only recognized as an undescribed species at the time of discovery but has also revealed a new finding almost nine decades after its description. A paratype of *P. fimbriata* was examined in the Natural History Museum of Los Angeles County, USA and the hydroid *Bimeria vestita* Wright, 1959 was found attached to an anterior scale of the worm. The interaction between *B. vestita* and *P. fimbriata* in this study represents the first record of epibiosis of a hydroid on a sigalionid scaleworm. This discovery contributes to our understanding of epibiosis in Hydrozoa and opens new avenues for further research in this area.

Key words: epibiosis, Medusozoa, Polychaeta, Tropical Eastern Pacific

Introduction

Scaleworms (Annelida, Aphroditiformia) are well known for sustaining symbiotic relationships with other invertebrates, either as commensals, mutualists, or, uncommonly, as parasites (Martin & Britayev 2018; Taboada *et al.* 2020; Taboada *et al.* 2021). Among the scaleworms, the family Polynoidae Kinberg, 1856 is known for having diverse symbiotic relationships with other phyla, such as echinoderms, mollusks, sponges, and cnidarians (Pettibone 1993; Britayev & Lynski 2002; Britayev *et al.* 2003; Taboada *et al.* 2020; Fassio 2024).

Cnidarian hosts of scaleworms include soft corals, either on their surface or inside cavities, using them as a refuge (Martin & Britayev 2018; Barnich *et al.* 2013; De Assis *et al.* 2019). Other records include hydrozoans as hosts, with the worms inhabiting the surface of the colony (Hartmann-Schröder 1992; Martin & Britayev 1998; Nishi & Tachikawa 1999; Di Camillo *et al.* 2011; Molodtsova *et al.* 2016). These kinds of interactions usually constitute a commensal relationship, where the scaleworm obtains a benefit while the cnidarian neither benefits nor is harmed (Wahl 1997; Molodtsova *et al.* 2016).

On the other hand, scaleworms can also act as a substrate for other organisms, including hydroids. Recently, in Antarctica, bougainvilliid hydroids have been recorded on the chaetae of *Laetmonice producta* Grube, 1877, a scaleworm belonging to the family Aphroditidae Malmgren, 1867, a group in which epibiosis is highly common (Parapar *et al*. 2013). Records of epibiont hydroids on polychaetes are scarce, consisting mainly of observation of hydroids on their tubes (*i.e.*, onuphids, sabellids, serpulids) (Calder 2010; Calder 2019). No specificity has been observed since the hydrozoans tend to grow on a wide variety of natural substrates (*e.g.*, algae, seagrass, sponges, corals, polychaetes, mollusks, crustaceans, bryozoans, ascidians, and fish) (Gili & Hughes 1995; Widmer *et al.* 2009; Dziubnska & Sapota 2013; Mendoza-Becerril *et al.* 2018; Monti *et al.* 2018; Calder 2019; Calder *et al.* 2022; Maggioni *et al*. 2024).

Unlike in Aphroditidae, in the family Sigalionidae Kinberg, 1856, epibiosis is represented by ciliates and entoprocts growing on chaetae, scales (elytra), and body (Wehe 2007; Mikac *et al.* 2020). Nevertheless, there is a sigalionid genus that can attach diverse particles to its body, and even animals. Members of the genus *Pelogenia* Schmarda, 1861 stand out by having the body and scales covered with adherent papillae, in which sediment can be

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attached, such as sand, small rocks, diatoms, and foraminifera tests, and other remains of animals such as mollusks, bryozoans, entoprocts, echinoderms, crustaceans, cnidarians and even other polychaetes (Pettibone 1997; Wehe 2007; Goto & Tanaka 2019; Cruz-Gómez 2022).

This study documents the presence of an epibiont hydroid on the scaleworm *Pelogenia fimbriata* (Hartman, 1939) (originally described as *Psammolyce fimbriata* Hartman, 1939) from Panama's Pacific coast. This observation is the first record of a hydrozoan epibiont within the family Sigalionidae.

Material and methods

The specimens of *Pelogenia* from the Natural History Museum of Los Angeles County, Los Angeles, California, USA (LACM-AHF) collected from the Secas Islands, Panama (7°57'55"N, 82°00'30"W) at a depth of 45 m, during one of the Allan Hancock Pacific Expeditions (Hartman 1939; Fraser 1943), were examined and observed a well-preserved hydroid on a scale of a paratype of *Psammolyce fimbriata* Hartman, 1939 (LACM-AHF 1576).

Taxonomic identification of the scaleworm was confirmed following the sigalionid revisions (Pettibone 1997; Cruz-Gómez 2022). The scale was examined using a stereo microscope and photographed with the attached hydroid. Then, the scale was removed carefully from the body. The colony was identified using taxonomic descriptions available in the literature, such as Calder (1988), Schuchert (2007), Mendoza-Becerril *et al.* (2017). This colony was studied with an Olympus BX51 optical microscope, and images were taken with a Canon Rebel T3i and T8i camera. Additionally, detailed hydroid images were obtained with a low vacuum (30Pa) and freezing platina to -24°C, using the sublimation method (Beckett & Read 1986; modified by Elías-Gutiérrez unpublished data) attached to a JEOL-JSM-6010LA scanning electron microscope (SEM) at ECOSUR-Chetumal. The imagery was processed with Helicon Focus software (edition 8.2.0) and Topaz Photo AI (edition 2.3.1). Final plates were made using Photoshop CC software.

Results

Superorder Anthoathecata Cornelius, 1992

Order Filifera Kühn, 1913

Family Bougainvilliidae Lütken, 1850

Genus *Bimeria* Wright, 1859

Bimeria vestita Wright, 1859

Figs. 1A–H

Material examined. LACM-AHF 1576a, Panama, Gulf of Chiriquí, Secas Islands, 7°57'55''N 82°00'3''W, 45 m, *R/V Velero III*, Sta. 250-34, February 22, 1934, on the 5th right anterior scale of *Pelogenia fimbriata*, the fertile colony was 1 mm above the dorsal line of the worm and extended to the lateral sides of the scale about 0.5 mm; proximally, over posterior scales and the dorsal midline, distally, right above the chaetae.

Description. Mature colony small (1.5 mm high), stolonal, monosiphonic, arising from creeping tubular stolons (Figs. 1A–E). Bilayered exoskeleton formed by perisarc and exosarc. Perisarc continuous from hydrorhiza to tentacle base unwrinkled at the base of hydrocaulus. Exosarc thin, thinner over hydranth, tentacle base, and hypostome, forming a pseudohydrotheca (Figs. 1D, F, H). Hydranth vasiform, merging with short pedicel. Hypostome conical, 10–12 tentacles in two very close whorls (Fig. 1F). Gonophore fixed sporosac on hydrorhiza, pedicellate, ovoid, without radial canals, enveloped in the thin exoskeleton (Fig. 1E). Nematocysts of tentacles: microbasic eurytele and desmoneme (Fig. 1G).

Distribution. Circumglobal in temperate and tropical waters (Calder 2013). Records in the Eastern Pacific Ocean are restricted to Mexico and Panama (Fraser 1938a, 1938b; Mendoza-Becerril *et al.* 2020).

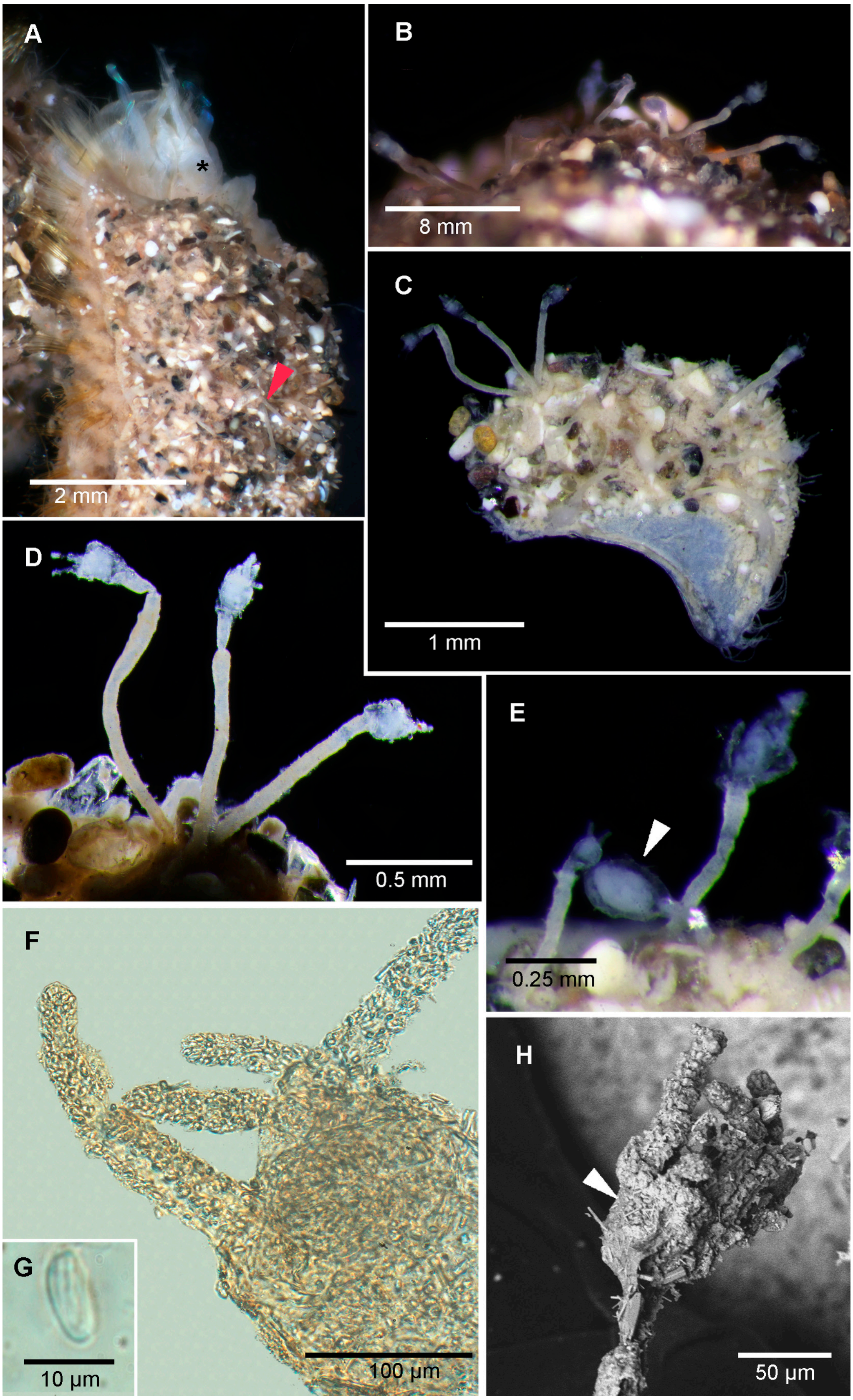

FIGURE 1. Epibiosis of *Bimeria vestita* Wright, 1859 on *Pelogenia fimbriata* (Hartman, 1939) (LACM-AHF Poly 1576a). A. Anterior end of *P. fimbriata*, dorsal view, the asterisk indicates the prostomium, and the arrowhead indicates *B. vestita* attached to the scale. B. Hydroid colony on the surface of the scale still attached to the dorsum, side view. C. Anterior scale removed. D. Close-up of hydrants. E. Close-up of the colony, arrowhead indicates gonophore. F. Detail of tentacles. G. Nematocyst microbasic eurytele. H. SEM of a hydrant, arrowhead indicates pseudohydrotheca.

Remarks. See Calder (1988) and Schuchert (2007) for taxonomic details and synonyms of this species. There are currently five species of the genus *Bimeria* (WoRMS 2024). The species *B. vestita* is distinguished from the remainder of the genus species by the proximal part of its tentacles being ensheathed with an exoskeleton (Calder 1988; Schuchert 2007).

Discussion

Epibiosis is recorded between the hydrozoan *Bimeria vestita* and *Pelogenia fimbriata*, a scaleworm different from other species of the genus by the presence of middorsum lobe of segment II rounded; neurochaetal handles with 0–3 transverse rows of spines, and blades entire or bifid (Pettibone 1997; Cruz-Gómez 2022). This relationship is always between two living organisms, where the epibiont is attached to the body surface of another organism called basibiont and when abiotic and biotic conditions are adequate (Wahl 1997, 2008; Fernandez-Leborans *et al.* 2017). The epibiosis between benthic invertebrates and polychaetes has been observed mainly on the dorsal surface (Parapar *et al*. 2013).

Hydroids tend to be predominantly substrate generalists and are commonly recorded as epibionts of other organisms because they can attach to various surfaces (Calder 1976; Gili *et al.* 1989). Like other hydrozoans, *B. vestita* does not prefer a particular substrate, being recorded on other hydroids, brown and red macroalgae, sponges, polychaetes, and mollusks (Genzano & Zamponi 1999). The size of their colonies is variable according to the type of substratum (1.5–25 mm); colonies attached to other hydrozoan species tend to grow larger, while colonies attached to other natural substrates are smaller (Calder 1988; Genzano & Zamponi 1999; Schuchert 2007). The colony described here was small (<2 mm), possibly due to limited space available on the scale. Based on the size of the hydrants and the presence of gonophores, the colony was at least a few months old. Indeed, in *B. vestita*, the development of gonophores normally appears a few months after the settlement (Genzano & Zamponi 1999).

In natural environments, the bilayered exoskeleton of *B. vestita* is always encrusted with organic and inorganic material but thinner in young polyps when the colony is in a culture condition (Mendoza-Becerril *et al.* 2017). In this case, the hydroid exoskeleton is thin but not fragile. This condition might be caused by several factors, such as the size of the hydroid, the environment, the mobility of the worm, as well as the interaction and competition with the adhesive papillae of the worm's scale. In both cases, the hydroid and worm's papillae passively attached particles to their surfaces. Therefore, the elements attached to the worms and the hydroids depend on what is available in the environment.

Sigalionids are considered burrower polychaetes; they can be found inside fibrous tubes made by special chaetal sacs or in burrows in the sediment constructed with mucus (Jumars *et al.* 2015; Eibye-Jacobsen *et al.* 2022). By hiding in the sediment, these worms can be safe from predators and wait for suitable prey (Jumars *et al.* 2015). In the case of *Pelogenia*, being covered by sediment particles could also offer them an advantage as camouflage while hunting using the sit-and-wait strategy or actively hunting. Members of *Pelogenia* likely share the burrowing biology of other sigalionids, as indicated by some aspects of their morphology, such as presenting the first three anterior segments displaced anteriorly, the presence of only simple verticillate chaetae in tentacular segment bears, and the second and third ones coupled with enlarged noto- and neurochaetae (Pettibone 1997; Cruz-Gómez 2022). A similar morphology was observed in *Sthenelais berkeleyi* Pettibone, 1971, a burrowing sigalionid that lives quietly in the sediment until prey appears (Pernet 2000). This suggests that *P. fimbriata* may use the same strategy.

The available evidence from the study of epibiotic hydroids indicates the existence of symbiotic interactions with other invertebrate species, which may involve protection or predation (Osman & Haugsness 1981; Piraino *et al*. 1992; Montano *et al.* 2017). We, therefore, suggest that this interaction should be further investigated and that researchers should carefully examine specimens of scaleworms in scientific collections or field observations to gain a deeper understanding of the occurrence and dynamics of this relationship.

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